

# PATENT SPECIFICATION



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## PROVISIONAL SPECIFICATION.

### Improvements in Sparking Plugs for Internal Combustion Engines.

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AUTOMOTIVE

I, ARTHUR ERNEST MACDONALD, of 5, St. John's Road, Golders Green, London, N.W. 11, a British subject, do hereby declare the nature of this invention to be

as follows:—

This invention relates to sparking plugs for internal combustion engines, and more particularly to sparking plugs of the type in which an insulator supporting the central electrode is fitted to the body of the plug and/or to the electrode itself by means of a spherical, conical or like seating adapted to form a gas-tight joint without the use of packing or cement at such seating.

According to the present invention the said insulator is held upon its seating by pressure exerted upon it by the electrode or conductor in a universal self-aligning manner and preferably from a point located approximately at the intersection of the axis of the electrode with the normal to the spherical, conical or like seating. Thus where two spherical or like seatings are employed, both seatings are on the same side of the said point of intersection, and the pressure upon the two seatings is not affected if the seatings are not quite square one to the other.

In one form of construction, employing a main insulator enclosed in a recess in the plug body and carried by a ring or nut detachably connected to the body, and an outer insulator seated in the said ring around the projecting stem of the electrode, with the usual terminal nuts and tensioning spring or washer arranged upon its upper end, the main insulator has a bevelled or part-spherical annular shoulder at about the middle of its exterior surface, this shoulder fitting in a gas-tight manner against a corresponding bevelled or part-spherical seating on the inside of the detachable ring or nut. The central electrode is provided with a collar, preferably integral therewith and having

a part-spherical annular face which bears upon a similar surface on a small cap or washer of nickel or other suitable material fitted to the lower end of the main insulator. The tension produced in the central electrode by the spring or washer at its upper end is transmitted by the collar through the main insulator to the seating of the latter upon the detachable ring or nut, the position of the collar being such that the centre of its spherical surface coincides approximately with the centre of the spherical seating above the insulator, or with the intersection of the axis of the electrode with a normal to that seating when the latter is of conical or like shape.

In another form of construction, where a portion of the central electrode between two separated insulators is exposed for cooling inside a ventilated chamber in the plug, the main insulator is arranged in an inverted position as compared with that described above, its part-spherical or like shoulder seating upon a corresponding annular surface on the bottom of the chamber and being held down by a collar upon the electrode. The pressure applied to the seatings may be exerted by means of a conductor rod passing through the upper insulator and having its lower end engaged in a hole extending from the top of the electrode to a point approximately at the centre of the part-spherical or like seatings; for example the collar upon the electrode may be afforded by a cylindrical head terminating the electrode at the top of the main insulator, this head being recessed to receive the tip of the conductor rod, which is pressed down by an elastic disc enclosed in a cap secured to the top of the upper insulator, the latter in turn being held in the plug body by a notched or apertured ring screwed into the top of the chamber or attached thereto by beading over the rim of this

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chamber, and the lower end of the upper insulator extending down to the level of the electrode, so as to surround the top of its cylindrical head or collar. In this construction the under surface of the cylindrical head and the adjacent end of the main insulator need not be spherical, but may be flat, the self-adjusting or universal motion being allowed by the tip of the conductor rod, which forms in effect a ball joint.

The insulators employed may be of

any suitable material; the main insulator is preferably of fused silica, which allows the formation of gas-tight joints by grinding the faces into their seatings in the well known manner.

Dated the 30th day of September, 1925.

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## COMPLETE SPECIFICATION.

### Improvements in Sparking Plugs for Internal Combustion Engines.

I, ARTHUR ERNEST MACDONALD, of 5, St. John's Road, Golders Green, London, N.W. 11, a British subject, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to sparking plugs for internal combustion engines, and more particularly to sparking plugs of the type in which an insulator supporting the central electrode is fitted to the body of the plug and/or to the electrode itself by means of a spherical, conical or like seating adapted to form a gas-tight joint without the use of packing or cement at such seating.

Sparking plugs of this type are known, having the central electrode supported by two separated insulators, in which the barrel of the plug is provided interiorly with a bevelled seating against which the lower insulator is held by means of the spring-tensioned central electrode, and the head of the latter rests upon the lower surface of said insulator by means of an oppositely directed conical seating, the electrode and insulator seatings being coaxial and self-centering.

The present invention consists of a modification of this arrangement, whereby the lower insulator is held upon its seating in the plug body or barrel by pressure exerted upon it by the central electrode or conductor in a universal self-aligning manner at or adjacent to the other seating, so that the gas-tightness of the insulator is not affected if the two seatings are slightly out of truth as a result of inaccuracies in manufacture.

According to the invention, the lower insulator is held upon its part-spherical, conical or like seating in the plug body by pressure exerted upon it by a part-

spherical seating face on or attached to the central electrode or conductor, the centre of curvature of this face being located on the side remote from the first-mentioned seating and approximately at the intersection of the axis of the electrode with a normal to said first mentioned seating. Thus the two seatings are substantially concentric with one another, if regarded as part-spherical surfaces (to which form the annular conical seating approximates), and they therefore permit the insulator to seat itself in a universal self-aligning manner, as in the case of a ball-joint.

The invention is hereafter described with reference to the annexed drawings, in which:—

Figure 1 is a sectional elevation of one form of construction, and Figure 2 is a similar view of another form of construction.

The form of construction represented in Figure 1, employs a main insulator *a* enclosed in a recess *b* in the plug body *c* and carried by a ring or nut *d* detachably connected to the body *c*, and an outer insulator *e* seated in the ring *d* around the projecting stem of the electrode *f*, with the usual terminal nuts *g* and tensioning spring or washer *h* arranged upon its upper end. The main insulator *a* has a bevelled or part-spherical annular shoulder *a'* at about the middle of its exterior surface, this shoulder fitting in a gas-tight manner against a corresponding bevelled or part-spherical seating *d'* on the inside of the detachable ring or nut *d*. The central electrode *f* is provided with a collar *f'*, preferably integral therewith and having a part-spherical annular face *f''* which bears upon a similar surface *i'* on a small cap or washer *i* of nickel or other suitable material fitted to the lower end of the main insulator *a*. The tension produced

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in the central electrode *f* by the spring or washer *h* at its upper end is transmitted by the collar *f*<sup>1</sup> through the main insulator *a* to the seating of the latter upon the detachable ring or nut, the position of the collar being such that the centre of curvature of its spherical surface coincides approximately with the centre of curvature of the seating above the insulator, when such seating is of part-spherical shape, or with the intersection of the axis of the electrode with a normal to that seating, when the latter is of conical or like shape. In either case the upper seating is substantially concentric with the part-spherical face *a*<sup>1</sup>. It will be observed that even if the seatings are not square one to the other, that is, if the axis of the electrode is slightly out of truth with the axis of the insulator, a proper gas-tight joint is obtained by reason of the universal self-aligning effect.

In the form of construction represented in Figure 2, a portion of the central electrode *f* between two separated insulators *a* *e* is exposed for cooling inside a ventilated chamber *j* in the plug; in this construction the main insulator *a* is arranged in an inverted position as compared with that described above, its part-spherical or like shoulder *a*<sup>1</sup> seating upon a corresponding annular surface *a*<sup>1</sup> on the bottom of the chamber and being held down by a collar upon the electrode *f*. The pressure applied to the seatings may be exerted by means of a conductor rod *k* passing through the upper insulator *e* and having its lower end engaged in a hole *k*<sup>1</sup> extending from the top of the electrode *f* to a point approximately at the centre of curvature of the part-spherical or like seating; for example, as shown, the collar *l*<sup>1</sup> upon the electrode may be formed as a cylindrical head *l* terminating the electrode at the top of the main insulator, this head being cupped to receive the tip of the conductor rod *k*, which is pressed down by an elastic disc *m*<sup>1</sup> enclosed in a cap *m* secured to the top of the upper insulator *e*, the tip of the conductor rod thus centering itself automatically in the cup. The insulator *e* in turn is held in the plug body by a notched or apertured ring *n* either screwed into the top of the chamber *j* or attached thereto by beading over the rim of this chamber; the lower end of the upper insulator *e* extends down to the level of the electrode *f* so as to surround the top of its cylindrical head *l* or collar *l*<sup>1</sup>. In this construction the under surface of the cylindrical head *l* and the adjacent end of the main insulator *a* need

not be spherical, but may be flat, as shown, the self-adjusting or universal motion being allowed by the tip of the conductor rod *k*, which forms in effect a ball-joint so that the gas-tightness of the insulator is not affected by inaccuracies in manufacture.

The insulators employed may be of any suitable material; the main insulator is preferably of fused silica, which allows the formation of gas-tight joints by grinding the faces into their seatings in the well known manner.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A sparking plug of the type mentioned characterized by the fact that the insulator is held upon its part-spherical, conical or like seating by pressure exerted upon it by a part-spherical seating face on or attached to the central electrode or conductor, the centre of curvature of this face being located on the side remote from the first mentioned seating and approximately at the intersection of the axis of the electrode with a normal to said first mentioned seating.

2. A sparking plug, according to Claim 1, in which the inner end of the electrode bears upon the lower end of the insulator by a part-spherical face, and the said insulator has an annular shoulder on its exterior surface bearing against a spherical, conical or like seating provided inside the plug body, said seating being substantially concentric with said part-spherical face.

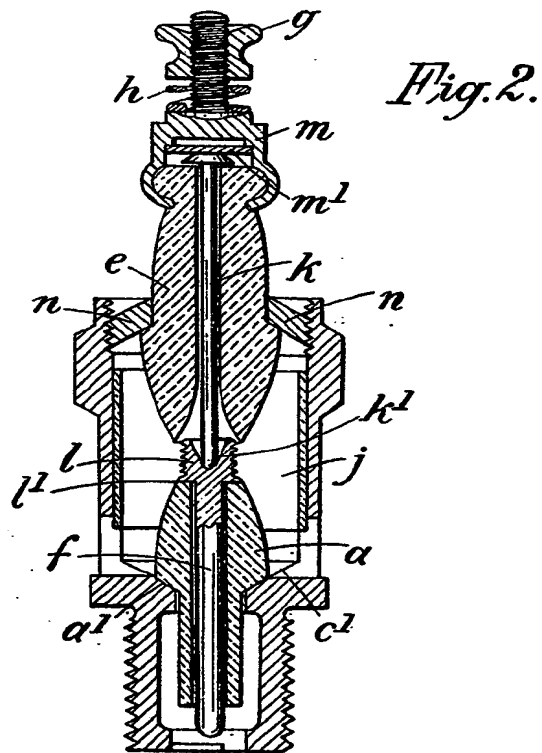
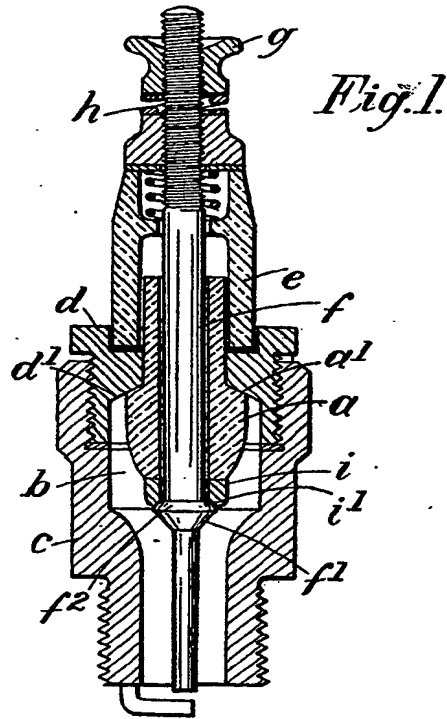
3. A sparking plug, according to Claim 1, in which the insulator has an annular shoulder on its exterior surface bearing against a spherical, conical or like seating provided inside the plug body, and is held down upon said seating by a collar upon the electrode, pressure being applied by a conductor rod passing through an upper insulator and having its lower end in engagement with said electrode, said seating being substantially concentric with the point of application of the pressure.

4. The improved sparking plug substantially as described and as illustrated in Figure 1 or Figure 2 of the accompanying drawings.

Dated this 29th day of June, 1926.

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[This Drawing is a reproduction of the Original on a reduced scale.]



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